

Types of Investigation

Descriptive, Experimental, Comparative



Descriptive

Observations are made during descriptive investigations and data is collected. These observations and data are used to help draw conclusions.

Types of Data

Qualitative: Descriptive

Quantitative: Numbers



Steps of this scientific method:

- 1.) Question
 - 2.) Observations
 - 3.) Analysis
- NO Hypothesis

Experimental

A controlled experiment tests one manipulated variable at a time. Every other variable stays the same.

Types of Variables

Constant Variables: The variables that stay the same during an experiment.

Manipulated variable: (Independent) Deliberately changed so that it can be tested.

Responding variable: (Dependent) measurable factor that changes depending on the manipulated variable.

Steps of this scientific method:

- 1.) Question
- 2.) Observations
- 3.) Hypothesis
- 4.) Design experiment and test
 - Manipulated variable
 - Responding variable
 - Constant variables
- 5.) Collect data
- 6.) Analyze and conclude

Comparative Inquiry

Involved collecting data on different organisms/events/objects/features or collecting data under different conditions. Very similar to experimental except no control is identified.

Steps of this Scientific Method:

- 1.) Question
- 2.) Observations
- 3.) Hypothesis
- 4.) Design experiment and test
 - Manipulated variable
 - Responding variable
- 5.) Collect data
- 6.) Analyze and conclude

What is a theory?

A theory is a very well test explanation of some aspect of the natural world. There is vast multitudes of experimentation and data to back up a theory usually. As we learn more about a subject, we can modify or change the theory to make it better.

(Common usage of the word theory means something is speculative or unproven; very different that the way scientists use it!)

Is a theory different than a law?

Yes!

Scientific laws are simple, concise, universal and absolute. They usually are accompanied by a mathematical equation. They describe one single action.

Theories are more complex and dynamic.

Both are used to advance technology and make predictions.

So what is a Hypothesis?

A hypothesis is a rational explanation of a single event based on observations. Hypothesis are supported, refuted, or changed based on experimentation and more observations. A hypothesis may become a theory or part of a theory after repeated experiments have the same conclusion.

What is a fact?

A fact is something that exists in reality. It is something that is known to be true by experience or observation.

Lets practice!

Identify the following as either: fact, hypothesis, theory, or law.

An apple falls to the ground when you let it go.

Bodies of mass are attracted to one another base on this formula:

$$F = G \frac{m_1 m_2}{r^2}$$

If you throw a ball in the air, then it will fall back to Earth with the same velocity as a ball dropped from the same height.

Objects gravitate towards one another because they have mass and the atoms of each want to be together in the simplest form of mass: a sphere.

Ridiculous Roaches

The Science wing has a **problem**: We have roaches in the science rooms! Oh no! We need to solve this problem efficiently as we are on a tight budget. The **question** is: What is the most effective insecticide for killing a roach population?

Observations: Quarterly exterminator visits don't seem to have an affect on the population of roaches. Roaches are still seen even once all the food, drinks and gum have been removed from the science rooms. The roaches are too smart to go into the little black traps. The traps never have any roaches in them.

Hypothesis: If the insecticide with the highest concentration of roach killing chemical will be the most effective, then Raid is going to be the most effective method because it has the highest concentration of chemicals compared to the other competitors.

The experiment:

The best way to test this would be a controlled experimental inquiry.

Manipulated variable: different insecticides (Raid, Hot Shot, Amdro, and COMBAT)

Responding variable: The number of roaches that die.

Constant variables: The number of roaches in a dish, the size of the dish, the amount of product used, the amount of time allowed for product to work, the same application methods, species of roach

Procedure, Data and Analysis

The **procedure** is the steps of an experiment. There will be 5 covered petri dishes in the this experiment, each with 15 of the same species of roach. The first petri dish will receive no insecticide. This is called the **control**. The remaining four will each get 30 grams of pesticide, one type in each dish. After 24 hours, the number of dead roaches will be counted (quantitative **data**). The **analysis** of the experiments will include a summary of the insecticides. The chemical that causes the highest number of roach deaths will be the most effective way of solving the problem of ridiculous roaches in the science wing.